Light and Lighting

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Contents

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Office Lighting

THOSE of us who are old enough to remember the lighting of offices in the days of the carbon filament lamp can appreciate how great is the advance that has been made in some of the offices now equipped with fluorescent lighting. Without the fluorescent lamp, it may be doubted whether, in post-war years, there would have been so much re-lighting of offices as has in fact occurred. No doubt there are a few individuals who would not agree that the new standards of lighting achieved in many of these re-lighted offices, as well as in new office buildings, are beneficial. There have always been such dissentients, and we recall that in the first volume of this Journal (1908) when the 16 c.p. carbon lamp was in common use, a writer complained that "many people were wearing glasses as a result of our abuse of modern improvements in lighting." To-day, it might be nearer the truth to say that people at work in some offices are wearing glasses because of failure to make use of modern methods and standards of lighting. Much remains to be done before the majority of offices will have good lighting.

Notes and News

The Colour Group

The annual general meeting of the Colour Group was held in the rooms of the Royal Photographic Society on Wednesday, March 21, at 3.30 p.m., when the report of the committee for the past session was presented. Eight science meetings had been held and a visit had been paid to Kodak, Ltd. A sub-committee had been appointed "To review the present situation regarding systems of colour description, to investigate the desirability of adopting a standard system, and to recommend any action which could be taken." It was reported that this sub-committee was nearing the completion of its work and its conclusions should be of great interest because the multiplicity of systems now in current use is a source of great embarrassment, not so much to physicists who use the C.I.E. system almost exclusively but to those working in industries having to deal with the surface colours of objects.

It was reported that Dr. T. Vickerstaff had been elected chairman of the committee for the coming session, Mr. R. G. Horner remaining as secretary for a further term. Dr. Vickerstaff is with Imperial Chemical Industries and has been an active member of the Group since its inception. He recently gave the Group an account of a visit he had paid to industrial and other laboratories in the U.S.A.

After the formal business had been concluded Dr. W. S. Stiles, the retiring chairman, vacated the chair in favour of Dr. Vickerstaff and gave his Chairman's Address entitled "The Bearing on Colour Theory of Some Recent Studies of Visual Sensitivity." He referred particularly to work of Brown and MacAdam in America on the precision of trichromatic matching. They used a horizontally divided comparison field, one-half of which was illuminated by a mixture of three stimuli (red, green and blue lights) in the proportions appropriate to some particular point on the colour triangle. Observers were then asked to match this mixture with a mixture of their own making, formed from the same three stimuli. In this way it was possible to determine the variations over which individual observers would range in obtaining a match for this particular colour and these variations were measured at a large number of points widely distributed over the colour triangle. Dr. Stiles discussed the significance of the results obtained on our ideas regarding colour vision and he referred also to other American work, particularly that of Crozier, and to work carried out in this country which had a bearing on the subject. After the conclusion of his address several members asked Dr. Stiles questions relating to particular points but the subject was clearly much too specialised to lead to a general discussion.

I.E.S. Meetings in London

The annual general meeting of the I.E.S. is to be held at 6 p.m. on Tuesday, May 8, at the Royal Institution, Albemarle - street, London, W.1. Following the formal business of the meeting an address on "Luminescence" is to be given by Prof. E. N. da C. Andrade.

On the day following the above meeting the I.E.S. annual dinner-dance is to be held at the Café Royal, Regent-street, London, W. The price of tickets is 30s. each.

Building Research Congress

It is understood that the organising committee of the Building Research Congress to be held in London in September is to consider closing the membership list for the Congress. More than a thousand delegates have already accepted invitations to attend, including the directors of building research of ten Commonwealth and continental countries and official representatives of many colonial and other countries.

Although the halls of the Institution of Civil Engineers, the Royal Institute of British Architects, the Institute of Structural Engineers, the Royal Institute of Chartered Surveyors, the Institute of Electrical Engineers and of the London County Council have been placed at the disposal of Congress members, the total accommodation is now barely sufficient to accommodate those who are expected to take part in the Congress.

Race and Colour

The idea of the average man—an imaginary being possessing properties which are the average over the whole population—has proved of great value in photometry and colorimetry and also in illuminating engineering. On looking closely at our internationally accepted standard observer in these subjects, however, we cannot fail to notice that he has a very Western appearance and that he speaks English, if with something of an American accent. Dr. Ishak, of the Ibrahim Pasha University, Cairo, drew attention to this in his recent address to the Colour Group on "The Colour Vision Characteristics of Egyptian Trichromats." Working in Dr. Wright's laboratory at Imperial College, Dr. Ishak had made complete determinations of the luminosity curve and the colour co-ordinates through the spectrum for a group of eight Egyptian observers, with some more restricted determinations of colour properties for a further group of seven Egyptians. He compared his results with the C.I.E. standard luminosity curve (based entirely on measurements on American observers), and with the C.I.E. colour co-ordinates (based entirely on Wright and Guild's work on British observers). He was able to show that when the spectral colour co-ordinates are expressed in a form which eliminates differences ascribable to different degrees of pigmentation, Egyptians differ only very slightly from British observers. With the luminosity curve—which must include the effects of pigmentation—the situation was less straightforward. The Egyptian results agree with the C.I.E. curve on the long-wave side of the maximum but as the blue end of the spectrum is approached they correspond to a significantly higher luminosity than indicated by the C.I.E. curve. On the other hand, in this region of the spectrum, the Egyptian results correspond to lower luminosities than what would now be regarded as the best determinations for Western observers (American work of Coblenz and Emerson and Gibson and Tyndall). Dr. Ishak expressed his bewilderment that attention had not been paid to these latter determinations in 1924 when the C.I.E. curve was laid down. The lower luminosities of the Egyptian subjects in the blue could be attributed to higher pigmentation, the character of the differences being consistent with an increased density of the yellow pigment covering the central area of the retina.

In the discussion it was emphasised that possible racial differences should be borne in mind when the question of a revision of the C.I.E. standard observer —which is already being discussed— came to be decided.

British Industries Fair

This year the British Industries Fair will be open until May 11. As usual, the Engineering and Hardware Section is being held at Castle Bromwich while the lighter products, including scientific instruments, are being shown at Earls Court and Olympia. An illustrated account of some of the exhibits of interest to the lighting engineer will be included in our next issue.

Dramatic lighting of the rood screen and nave altar at Canterbury Cathedral.

Lighting in Canterbury Cathedral

The re-lighting of places of historical interest presents an interesting but often difficult task for the lighting engineer. The lighting installed must conform with and, at the same time, enhance the architectural features of the building.

The re-lighting of Canterbury Cathedral was begun towards the end of 1946, after the consulting engineers, Winton Thorpe and Tunnadine, working in co-operation with Drake and Gorham, Ltd., had surveyed the existing installation and advised the Dean and Chapter that it was totally inadequate and in a very dangerous condition.

It was decided to re-use existing fittings with a new wiring installation in the Nave, Choir, Presbytery and Trinity Chapel and to install complete new schemes for the Chapter House, Crypt, Libraries, Cloisters and certain small chapels, staircases and roof spaces.

The original installation was on a D.C. supply and the opportunity was taken to change over to A.C. A new 3-phase 4-wire service was brought into the west end of the crypt and an ironclad panel-type switchboard installed. This board incorporates the fuseboards for the whole installation with the exception of the Chapter House, and all circuits are brought back to this point.

The whole of the wiring throughout the Cathedral has been carried out with "Pyrotenax" mineral insulated copper sheathed cables, installed generally on the surface, and great care and thought was given to the siting of cables in order that they are as inconspicuous as possible. In certain positions cables are laid in the joints between stonework and all visible cables are painted to match the stonework.

The general aim was to provide adequate levels of illumination without making the fittings too conspicuous a feature. To this end indirect lighting was adopted for the Chapter Houses and Crypt and floodlighting for the Choir Screen and Nave Altar.

The Chapter House

This was the first section of work to be dealt with and a feature has been made of the roof, the true beauty of which had not previously been fully seen due to the little daylight that enters through the stained-glass windows. The Chapter House which was the general meeting place of the monks, is 90 ft. long, 36 ft. wide and 65 ft. high, and it dates from the fourteenth century. This roof has waggon vaulting with gilded ribs and is constructed of Irish bog oak.

The lighting scheme consists of twenty 500-watt indirect reflector fittings mounted in eight groups, 15 ft. above floor level, four groups along each 90 ft. wall. The four end groups each contain two fittings and the four centre groups three fittings each. The switching is so arranged to give three intensities of illumination while maintaining even distribution of light over the entire building. This is achieved to a remarkable degree with a negligible amount of spill light on the walls. The fittings have segmented-type anodised aluminium reflectors with adjustable screens and they are concealed behind banks of panel heaters that had been installed a few months previously.

Switching is carried out by two two-way switches for 4 kw. of the load and by one single-way switch for the other 6 kw. These

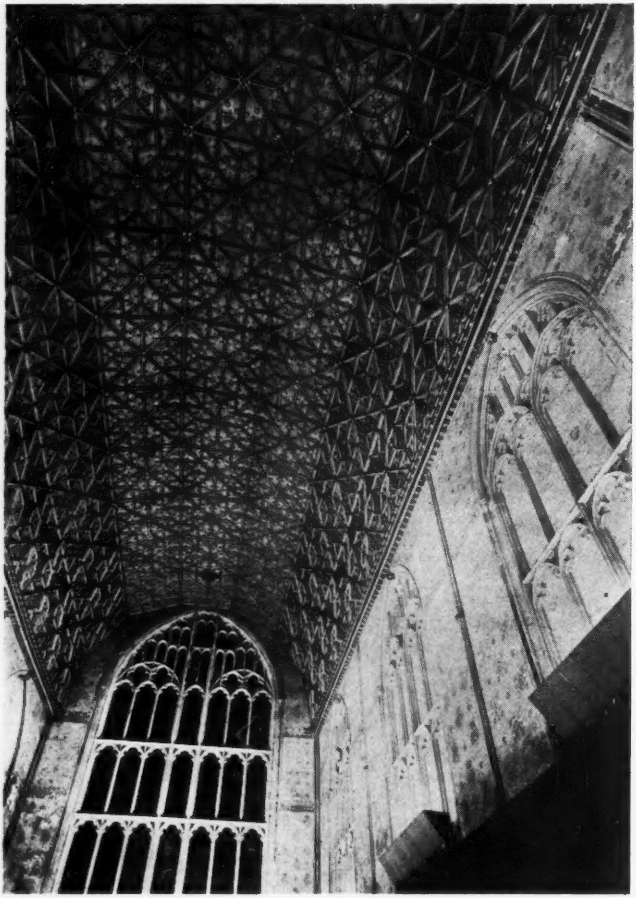

Fig. 1. The roof of the Chapter House lit by twenty 500-watt lamps in fittings concealed behind the heating panels seen on the right.

switches remote control two 15-amp T.P. and N. contactors mounted along with the main switch and fuseboards in a small kiosk outside the Chapter House.

The Nave and Choir

In the Nave and Choir the existing lighting fittings have been retained, but in all cases they have been completely overhauled and refinished. New floodlighting has been installed for the Nave Altar and flower vases and for the Rood screen that separates the Choir from the Nave.

These fittings have been designed to fit inconspicuously into the flutings of the massive columns and are made in bronze with the lamps mounted one above the other. In the case of the Rood screen (Fig. 2), the face of which covers an area approximately 35 ft. long by 25 ft. high, two fittings are used. Each have three 200-watt lamps with anodised aluminium reflectors and the whole front of the fittings, which are 3 ft. 6 in. high, consists of a hinged frosted-glass panel semi-circular in section. The fittings are mounted 25 ft. apart and 25 ft. in front of the Screen at a height of 30 ft. above the floor of the Nave which is 9 ft. below the floor at the base of the Screen.

The Nave Altar stands at the East end of the Nave immediately in front of the steps up to the Choir Screen. The floodlighting is

achieved with two specially designed bronze fittings, each having two 150-watt lamps mounted one above the other. The reflectors are of anodised aluminium and the front of the fittings have semi-circular frosted-glass panels. Both fittings are mounted at high level on pillars 20 ft. in front of the Altar and 32 ft. apart.

The existing fittings retained in the Nave consist of 500-watt lamps fitted into reflectors which are formed into the roof bosses 80 ft. above the floor. There are nine of these fittings along the centre of the Nave, spaced 21 ft. apart, and a further three in the choir and one each in the South Transept, Martyrdom, and above the High Altar. All have raising and lowering gear operated from the roof space above.

The Choir has additional lighting in the form of fourteen three-arm brackets fittings with 60-watt "Holophane" glass reflectors. These are fitted to the North and South screens behind the Stalls, 14 ft. apart.

A twenty-four light brass candelabra is suspended from the roof above the steps up to the High Altar. This fitting weighs 2½ cwt. and has raising and lowering gear. Supplementary lighting for the Altar consists of a number of 200-watt floodlight reflectors of orthodox design.

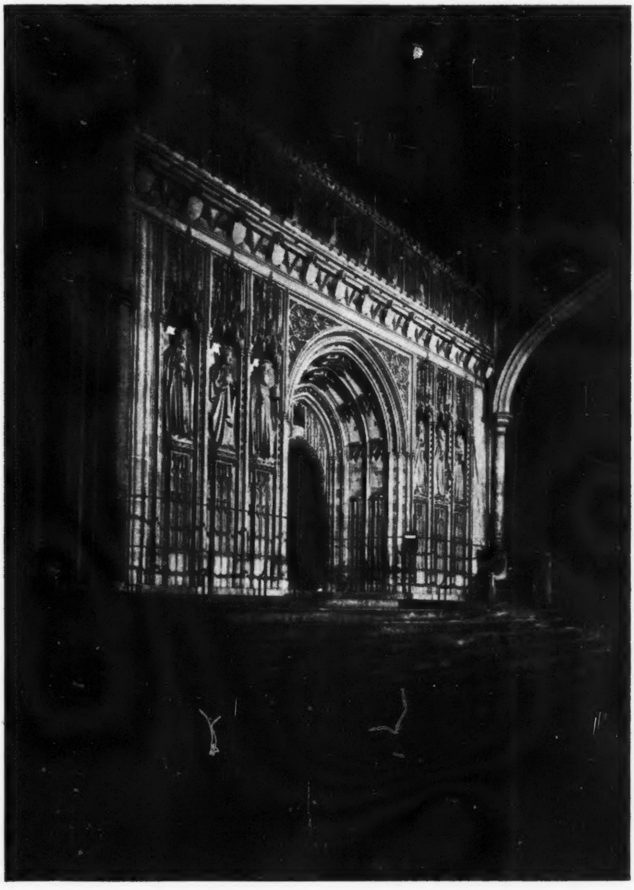

Fig. 2. Another view of the Rood Screen, illuminated by two specially designed floodlight fittings each housing three 200-watt lamps.

Fig. 3 *(Left)*. The Eastern Crypt.

Fig. 4 *(Below)*. The South Ambulatory of the Crypt looking eastwards.

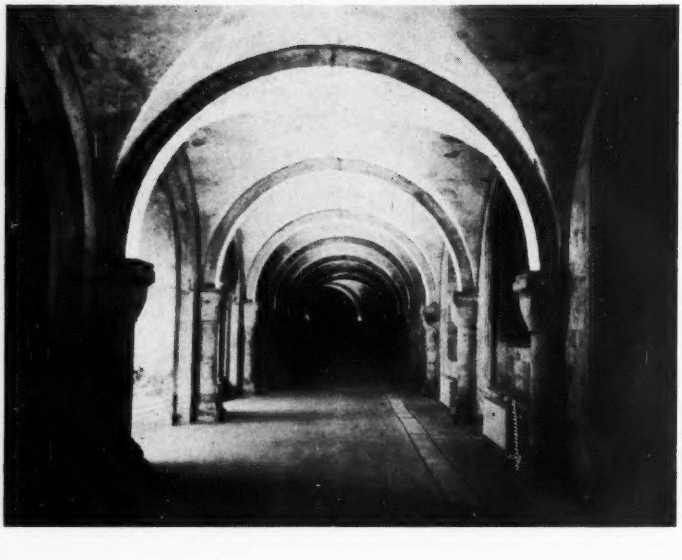

Fig. 5. The Chapel of Our Lady of the Undercroft, illuminated by four concealed bronze fittings each having two 75-watt tubular lamps.

The Crypt

The Crypt consists of two parts known as the Western and Eastern, the former being the largest work of its kind in England. Indirect lighting has been adopted for the Ambulatory of the Western Crypt and the whole of the Eastern Crypt. The centre section of the former is illuminated by eight 8-light wrought-iron candelabra fittings, six of which were existing and two new ones which were made to match. The lamps used in these fittings are 40-watt S.B.C. frosted candle-lamps, and the fittings are finished white and black.

The problem with the lighting of the Ambulatory was the siting of the fittings and the type to use. The only suitable position was the flat ledge 6 in. wide by 21 in. long on top of the capitals of the columns supporting the series of arches forming the roof. (See Fig. 4.) This ledge is 7 ft. 2 in. above the floor, and the top of the roof arches is 14 ft. above the floor.

Fittings were designed to fit this available space, and they have anodised aluminium reflectors for one 100-watt double-ended striplite lamp mounted horizontally. These reflectors are fitted into shallow sheet steel trays with adjustable spill-light reflectors and heat-resisting cover glasses. Provision had to be made for terminating three "Pyrotenax" cables in each fitting with space for one other to pass through. The complete fittings are only 2¼ in. high. Metal screens painted to match the stonework are fitted to the edge of the capitals, thus totally enclosing the fittings and cable glands. A total of forty of these fittings are installed.

In the Eastern Crypt (see Fig. 3), which is roughly semi-circular in plan, a similar system of illumination is adopted. The eight double circular columns are approximately 5 ft. x 3 ft. in section, and the fittings are placed on the capitals 11 ft. above floor level. Each capital is fitted with four anodised aluminium reflectors of segment pattern designed for use with 150-watt B.C. lamps.

The complete lighting scheme was designed by Winton Thorpe and Tunnadine, and was installed by Drake and Gorham, Ltd., who have had considerable experience in installations of this kind.

Fluorescent Lighting for Offices

Many people spend a large part of their time in offices of one kind or another. This article describes how the basic requirements for office lighting can be met by the use of fluorescent lamps.

By A. H. Nash* and J. C. Cahey

The basic requirements for office lighting are a high standard of visibility and visual comfort combined with economy of running costs. No less important, however, is the need for appearance, design and layout conforming to the architecture of the building.

As a result of the demand for considerably higher standards of suitable illumination since the last war we have seen many installations using the well-known advantages of fluorescent lamps but unfortunately many of these have been housed in equipment primarily designed for industrial use. Visibility and visual comfort in these cases have undoubtedly been improved but the overall effect is sadly incongruous.

The swing away from this misapplied enthusiasm must not be too sharp—the balance between efficiency and appearance must be preserved. For instance an ornate central fitting, however admirably it may match its surroundings, is of little use to the typist working against a wall in the corner of the room. Similarly, vertical fluorescent pendants pleasantly in keeping with a given style of architecture may be appreciated by the casual visitor, but they are likely to provide a greater illumination *in the eyes* of the office workers than on their desks. The

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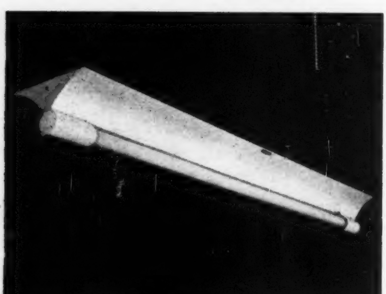
Fig. 1. (*Below*) Typical bare lamp fitting and (*Right*) polar curve. Unbroken line—in major axis of fitting. Broken line—in minor axis of fitting.



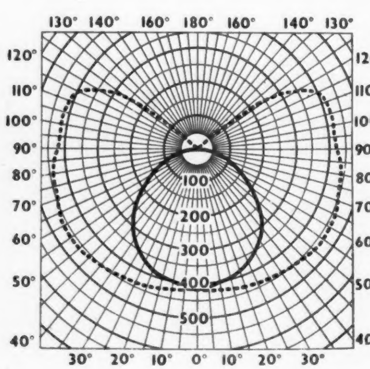


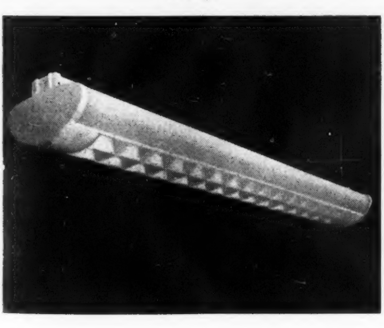
Fig. 2. *(Above)* Typical enclosed diffuser fitting and *(Right)* polar curve. Unbroken line—in major axis of fitting. Broken line—in minor axis of fitting.

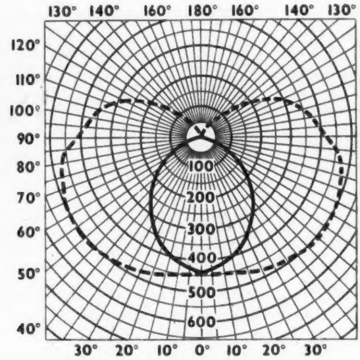
visual requirements for good office lighting are summarised below:—

(1) *A recommended level of illumination at the working plane with as little diversity as possible over the area.*

In small offices where one or two people are employed, a general plus local lighting system may be preferred on personal choice, but for main offices the general system is best. The diversity over the whole area is kept low by using this method so that workers can move away from their immediate visual tasks without having to adapt their eyes to sharp changes in brightness values. Desks and furnishings can be regrouped or increased as required without the need for alterations to the lighting scheme.

Fig. 3. *(Below)* Typical louvred bottom and side diffuser fitting and *(Right)* polar curve. Unbroken line—in major axis of fitting. Broken line—in minor axis of fitting.



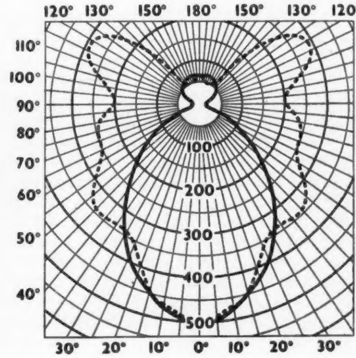


(2) *No glare from lighting fittings.*

Generally there is little reflected glare at desk level and where it does exist it can usually be corrected by changing the position of the papers or moving office machines to parts of the room where the image of the light source will not be seen in their polished surfaces. A more common fault is the discomfort glare derived from a fluorescent fitting and its background. This is most apparent when the fitting intrudes towards the centre of the field of view. It often occurs in rooms of low mounting height, but it can be noted in higher rooms where there is a long vista. This discomfort glare can be relieved by ensuring a background of adequate brightness.

(3) *A balanced ratio between the brightness of the visual task and surrounds.*

This requirement depends primarily on the reflection factors and finish of walls, ceiling and furnishings, but the lighting



PROPERTIES OF THREE TYPES OF FLUORESCENT OFFICE LIGHTING FITTINGS

	FITTING TYPE		
	BARE LAMP (See Fig. 1)	ENCLOSED DIFFUSER (See Fig. 2)	LOUVRED BOTTOM AND DIFFUSER SIDE SCREENS (See Fig. 3)
Recommended maximum spacing/ mounting height ratio for rectangular formation	Major axis 1.3 : 1 Minor ,, 2.0 : 1	Major axis 1.4 : 1 Minor ,, 2.0 : 1	Major axis 1.1 : 1 Minor ,, 1.6 : 1
Proportion of lamp lumens emitted by fitting	Up 26 per cent. Down 66 ,, ,,	Up 20 per cent. Down 55 ,, ,,	Up 24 per cent. Down 46 ,, ,,
Peak Candle Power	At 55 deg. from DV	At 52.5deg. from DV	At 0 deg. from DV
Lateral Brightness	Full lamp	Approx. 50 per cent. full lamp	Approx. 40 per cent. full lamp
Suitability	High background brightness is essential for this fitting so it is recommended for ceiling mounting only. The illumination on the ceiling in its vicinity will be insufficient if it is suspended. It is most effective when mounted well out of normal view i.e., in small rooms with high ceilings or well screened by deep beams in larger rooms	As this fitting is appreciably less bright than the bare lamp fitting greater flexibility of use is allowable	Although the efficiency of the fitting is lower it will be seen from the distribution curve that the peak candle power is obtained immediately below the fitting. This fitting, therefore, combines the advantage of full downward distribution and lateral screening

engineer should make suitable recommendations regarding them wherever possible as an essential to good lighting. If he has no choice but to accept conditions as they are, he can ensure that the best use is made of existing factors by using appropriate fittings.

To fulfil all these requirements a lighting fitting should have good components of upward and downward light and low brightness when in the general field of view. Since maintenance can be an important item in running costs, the fittings should be designed to give quick access to the lamps and auxiliary gear, while parts used as reflectors and screens should have a smooth finish which can be easily wiped over during routine cleaning.

A number of fittings are available for commercial applications and can be used effectively for office lighting provided their limitations are realised. They fall mainly into the categories of (1) bare lamp fittings, (2) enclosed diffuser fittings, and (3) fittings having a louvered bottom and diffuser side

Fig. 4. Showing the general lighting in a general office at Lever Bros. (Port Sunlight) Ltd.

screens. Notes on their various properties are given in the table as a guide to their use for office lighting. Typical single lamp figures only have been given.

These units, shown in Figs. 1, 2 and 3, have been designed to cover a number of commercial applications at currently acceptable prices. When users are prepared to go further, special fittings can be developed to provide a more balanced scheme designed to meet the requirements of their particular offices, and Figs. 4 and 5 show two examples of this type of scheme. In both instances care was taken to ensure a harmonious appearance while the essential

(*Continued on page* 179)

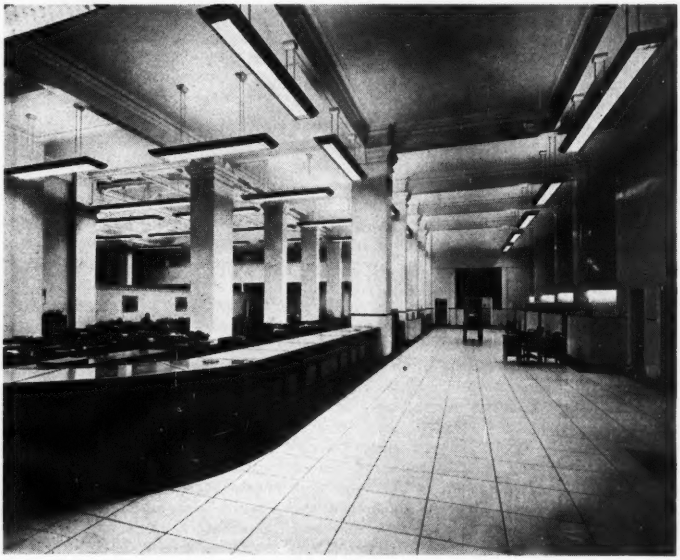


Fig. 5. View of the general reception office of the Canadian Pacific Railway Co. Ltd.

Physical Society Exhibition

Brief account of the exhibits of lighting and optical interest at the thirty-fifth exhibition.

This year's exhibition showed a still further improvement on those of previous years since not only was it again open for five days, but the space available was increased by the inclusion of several rooms in the Huxley Building of the Imperial College, adjacent to the Victoria and Albert Museum. Although this made it necessary for visitors who wished to see all the exhibits to walk from the main building across Exhibition-road, it was generally agreed that the reduction of congestion and consequent increase in comfort at the stands was well worth this minor inconvenience.

Apart from the exhibit of the Colour Group, which will be referred to later, the number of stands on which there was anything of direct lighting interest was again quite small. There were two photoelectric illumination photometers; one was the popular "autophotometer" of Everett, Edgcumbe and Co., Ltd., in which the cell was enclosed in a holder of new design, sealed so as to exclude moisture; the other was a "cosine-corrected" instrument, shown by Megatron Ltd., in which the cell was mounted in a case covered with a "Perspex" dome. The curves shown with this instrument indicated a very marked reduction in the error when measuring obliquely incident light, e.g., from 30 per cent. to about 7 per cent. for an angle of incidence of 75 deg. Megatron Ltd. were also showing a colour-temperature meter which depended in principle upon a measurement of the ratio of the responses from a photocell when covered respectively with a red and a blue filter. The Baldwin Instrument Company again showed their photometer incorporating as the sensitive device a vacuum type photo-emissive cell; the type of cell used depended on the nature of the measurements for which the instrument was intended. A picture of this photometer was reproduced last year (*Light and Lighting*, May, 1950, p. 177).

There were a number of what might be described as special-purpose instruments. For instance, glossmeters for measuring the degree of polish of a surface were exhibited both by Nash and Thompson Ltd. and by Evans Electroselenium, Ltd., the makers of the EEL photocells. In both cases the light from a small lamp incorporated in the instrument was incident on the sample at 45 degs., and a photocell was so placed that it measured the light reflected specularly from the sample at this angle. In the case of the instrument shown by Nash and Thompson and made by them to the design of the Paint Research Station, there was also a second photocell which received light reflected by the surface in the direction of its normal. The two cells were put in opposition in the galvanometer circuit and by means of an attenuator connected to the specularly illuminated cell the galvanometer reading could be reduced to zero when the sample was replaced by a diffusing surface. The instrument was thus adjusted to give a reading of the specular component only in the case of any given sample. To provide a constant (although arbitrary) scale, a piece of polished black glass was used and the sensitivity of the galvanometer was adjusted so that the reading was 100 when this glass occupied the place of the sample.

Unicam Instruments (Cambridge) Ltd. showed a photoelectric spectrophotometer for measuring the spectral transmission curves of chemical solutions, a special feature of the instrument being the sensitivity attainable, so that measurements covering a spectral band width of 10 μ or less became possible. On the stand of Hilger and Watts Ltd. (Hilger Division) there was a new type of microphotometer in which the density distribution along the photograph of a line spectrum could be seen displayed on a cathode-ray tube. Hilger's were also showing some Schwarz photoconductive cells with sensitive areas comparable in size to a sensitive linear thermopile.

It appears that these cells may well have applications in spectrophotometry.

A new and very interesting development is the "interference filter," which consists of a glass base on which are successively deposited, by evaporation in a high vacuum, a partially transparent film of metal, a film of transparent dielectric and then another partially transparent film of metal. With this combination there is a pronounced maximum of transmission at that wavelength which is four times or 4/3 times, 4/5 times, etc., the thickness of the dielectric film. The band-width transmitted is largely controlled by the thickness of the metal films. Such filters were being shown by Hilgers and by Barr and Stroud, Ltd., who also displayed circular graded neutral filters produced by depositing thin metal films of carefully controlled thickness on glass.

The deposition of thin non-metallic films by cathodic sputtering with a high-voltage discharge in a gas such as argon at low pressure was being demonstrated by Mr. J. S. Preston in the National Physical Laboratory section. Such films, probably of cadmium oxide, seem to be of great importance in the production of the modern photovoltaic cell.

Siemen's Research Laboratories had a number of interesting exhibits, including a range of phosphors, with peak emission in the red region of the spectrum, a number of new high-speed flash tubes giving an effective flash duration of less than 5 microseconds, and various applications of the finely divided silica coating now being used to obtain a good diffuser of high transmisson. They also showed the apparatus used for measuring the light output from a source such as a fluorescent lamp in a number of spectral bands. It was interesting to notice that the instrument was designed to work with eleven bands, three of the eight bands provisionally adopted by the I.C.I. being sub-divided.

The D.S.I.R. exhibits were all housed in the Huxley Building, and of principal interest to the illuminating engineer was the section in which the Building Research Station showed models of some of the apparatus used by them for the various researches which they have been conducting on different aspects of lighting and their effect on comfort and efficiency. In particular, the apparatus used for the study of discomfort glare was demonstrated. Some of this work was referred to by Dr. Hopkinson in the paper which he and Mr. W. Allen read recently before a joint meeting of the I.E.S. and the R.I.B.A.

The other demonstration was of apparatus being used in a study of the factors which govern the sensation of flicker when using light sources of fluctuating intensity, such as fluorescent lamps run on an A.C. supply. The apparatus shown gave an alternation between maximum intensity and zero, but it was stated that a modification was being planned to give a simulation of the actual light output cycle of a fluorescent lamp.

The History of Colour Vision Theory

From the point of view of anyone interested in lighting, quite the "high spot" of the exhibition was the series of exhibits arranged by the Physical Society Colour Group to show the development of our knowledge of colour and of colour vision. It was a surprise to most visitors to find that the first item in the exhibit referred to the work of Robert Boyle, once described as "father of chemistry and uncle of the Earl of Cork," and associated for ever with the gas law that bears his name. Before his time it was generally believed that the colour of a body was inherent in the body itself, but Boyle, on the basis of careful experimental work, concluded that colour was a stimulation of the eye and brain, and so he distinguished between subjective colour sensation and the objective conditions that produced it.

Next came a very attractive model of the room at Trinity College, Cambridge, where Newton carried out his famous experiments on the prismatic dispersion of white light, and close to this model his "colour circle" was shown. Goethe's theoretical speculations were noticed as an interesting digression from the main line of advance, and then came the founding of the trichromatic theory by Thomas Young and his explanation of the observations of John Dalton (the founder of the atomic theory in chemistry), who was a pronounced protanope (red-blind).

The work of J. E. Purkinje on the relative apparent brightnesses of coloured objects seen under a very weak illumination was published in 1823 and 1825, but its significance could not be fully appreciated until the development of the "duplicity theory" of vision some 40 years later as a result of the discovery of two types of receptors, the rods and cones, in the human retina. Meanwhile, a great deal of work had been carried out by a number of experimentalists on the phenomena of colour blindness and of colour

mixture. The chief names associated with this work were, on the theoretical side, Grassmann, and on the experimental side, Maxwell and Helmholtz. This work culminated in the publication of the monumental "Handbook of Physiological Optics," by Helmholtz, in 1869. An interesting exhibit in this section was Maxwell's original apparatus, which had been lent by the Cavendish Laboratory, Cambridge, where it is normally exhibited in a collection of historical apparatus associated with that Laboratory.

The discovery of visual purple by Boll was another milestone in our progress towards a fuller knowledge of the visual process, and an interesting colour-photograph showed, side by side, two flasks containing solutions of visual purple, one in the unbleached condition and the other after bleaching by exposure to light.

After a mention of Hering's "opponent colours" theory, the next exhibit referred to the discovery of a new type of colour defect by the third Lord Rayleigh (John Wm. Strutt), who found that certain colour defectives, although they had three-colour vision, nevertheless differed greatly from the normal observer as regards their matching of certain colours by mixtures of specified spectral components.

The work of Arthur König, much of it very careful measurement of just noticeable increments, was the next to be noted, in particular his determination of the least change of wavelength just perceptible to the normal observer at different parts of the spectrum. Then followed the long series of researches which formed the basis of colour measurement. Although the Lovibond tintometer had been invented in 1885, primarily with the object of controlling the colour of beer, trichromatic colorimetry had to await Abney's work on the additivity of luminosities, the principle which underlies all modern colorimeters and, in fact, the whole C.I.E. system of colorimetry.

Before this was fully developed, however, other so-called colour systems had been evolved, notably the Munsell system, which consisted of a number of coloured samples, or "chips," arranged and labelled on a systematic plan. Then, in chronological order, came the development of convenient and rapid tests for defective colour vision, particularly the Ishihara confusion charts, in which patterns of dots of many different colours were so arranged that, while a person with normal colour vision was able to distinguish quite clearly numbers or other distinctive shapes, the colour defective was unable to do this in the case of one or more of the charts, depending on the nature of his colour defect. After an exhibit of an early form of the Ishihara charts came a description of Nettleship's work on the inheritance of defective colour vision.

The long series of determinations of the colour-mixing characteristics of the average observer with normal colour vision formed the subject of the next exhibit, with particular reference to the work of W. D. Wright at the Imperial College, and of J. Guild at the National Physical Laboratory. This work provided the necessary data for the "standard observer," adopted by the I.C.I. in 1931 as part of the international system of colorimetry. A very interesting and informative piece of demonstration apparatus shown at this stage was a C.I.E. colour triangle in which the colour at each point was simulated by means of the appropriate Lobivond tintometer glass.

The final section of the exhibit was devoted to a description of the work of Ragnar Granit on the retinal receptors and their properties and his theory of "dominators" and "modulators."

The colour group are certainly to be most warmly congratulated on the success of this attempt, apparently the first ever made, to demonstrate the various stages by which our knowledge of the most complicated subject of colour vision has been advanced. The exhibits, interesting in themselves, were given even greater appeal to the average visitor by the inclusion of photographic reproductions of portraits of those whose work was being described.

Lectures

This year, instead of a number of short discourses repeated at intervals during the period of the exhibition, four lectures of about an hour's duration were delivered. The first was by Dr. G. E. R. Deacon, of the Admiralty Research Laboratory, Teddington, and was entitled "Electric Currents in the Sea," the second was a historical lecture on "The Age of Newton," by Dr. D. McKie, of University College, London, while the third, by Dr. F. P. Bowden, of the Department of Physical Chemistry in Cambridge University, dealt with "The Friction of Metals and Non-Metals and the Influence of Surface Films." The fourth lecture was by Dr. L. A. Sayce, on the work of the Light Division of the N.P.L., of which Dr. Sayce is the superintendent.

Fluorescent Lighting in Schools

In this series on school lighting, of which the following is the fifth article, it is desirable that the merits of fluorescent lighting as applied to schools should be discussed. It is generally appreciated that fluorescent lighting is not the answer to all lighting problems and in the case of schools there are particular circumstances which must be given careful consideration.

By J. F. ROPER,* A.M.I.E.E.

The illuminating engineer usually finds he has to effect a compromise between various conflicting requirements in the design of lighting installations, and school lighting is no exception. It is generally agreed that schools should be better equipped than in the past, though there is a reluctance to pay for the improvements, whilst, in addition, there is a call for economy in fuel. The engineer, therefore, is required to provide so many lumens per square foot and much more comfortable seeing conditions than have been usual in the past, at low capital and running costs.

This is a very tall order, incapable of complete fulfilment, but the lighting engineer just has to do the best he can with the equipment available. This includes the tungsten filament and the fluorescent lamp, but whereas the latter is becoming very much more widely used in almost every other interior lighting field, it is not at present used very much for school lighting. Let us examine fluorescent school lighting and see what advantages it has over filament lamp lighting, and how these advantages, if any, coincide with the aims of school lighting.

Firstly, the colour of light from "natural" or other near-white fluorescent lamps is sufficiently similar to daylight to enable blending of the two to be practically unnoticeable; it also ensures that subtle decoration combinations can be used safely. If, for some reason, either an accurate colour-matching light or one of distinctly warm tone is required it is only a matter of changing the lamps in a standard set of fittings.

Secondly, the depth of shadow cast can be controlled within wide limits. By careful attention to the type, location and orientation of the fittings, shadows caused by obstruction can be almost eliminated or, alternatively, shadows which determine or reveal form can be produced. Any long, thin object may cast appreciable shadow if it lies parallel to the major lamp axis, but very little if turned through 90 degrees. To obtain a high shadow content in the lighting, it is necessary to have comparatively little overlapping of the light from adjacent fittings and a relatively low mounting height will therefore generally be necessary.

Thirdly, the lamps are of low brightness and give highly diffused light. The visual comfort and efficiency possible with properly installed fluorescent installations greatly exceeds that of other light sources. After looking at many fluorescent installations, consisting of bare lamps mounted perhaps eight feet from the floor, one might well wonder how this can be true. Most lighting engineers must by now, however, have learned that fluorescent lamps can be glaring and unpleasant when unscreened.

One of the tasks of the lighting engineer before the war was to diffuse the light from a small source so that it appeared to come from a much larger area. In the fluorescent lamp this aim is to some extent achieved automatically, but, owing to the size and shape of the lamp, the degree of visual discomfort experienced when looking at it depends very much on the direction of view.

* Lighting Service Bureau.

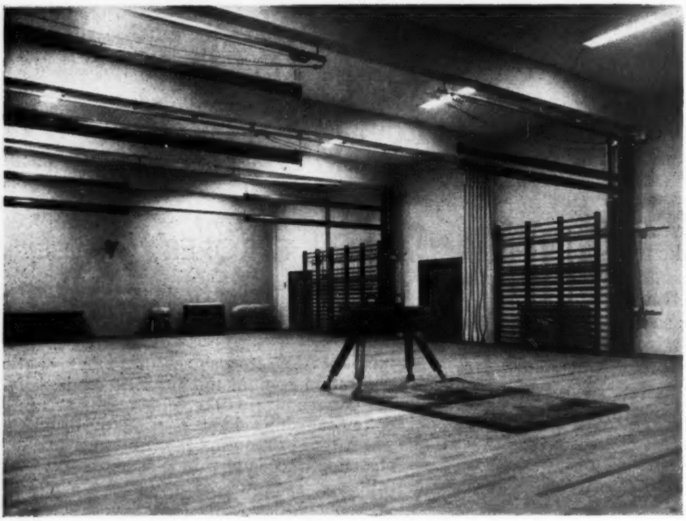


Fig. 1. Gymnasium with fluorescent lighting. Twelve fittings each containing two 80-watt lamps are recessed in the ceiling at a height of 16 ft. Average level of illumination on the floor is 10 lm/ft^2.

Even under the most favourable conditions exposed fluorescent lamps will give about the same discomfort as a similar number of tungsten lamps in enclosed diffusing fittings in the same positions and giving equal light output; and with the latter type of fitting one cannot normally get an illumination of more than about 15 lm./ft.^{2} with any reasonable degree of comfort.

The recent work of the Building Research Station and other organisations has reinforced the conclusion that bare fluorescent lamps visible at the usual angles of vision are unsatisfactory, especially at and above the illumination levels recommended for schools, and although they will be less uncomfortable the smaller the effective area seen, an installation will not be good unless the lamps are completely screened. An easy and satisfactory way of doing this is by the use of louvres and relatively cheap louvred fittings giving plenty of upward light and screening the lamp from normal directions of view have been used most successfully in schools and elsewhere.

Brightness control by louvres is quite different from control by diffusion. The addition of louvres does not materially increase the size of the apparent source of light, and all visible lighted surfaces of the fitting are of low brightness. Brightness control by diffusion involves increasing the visible luminous area, but this in itself is likely to cause glare unless the surfaces are made sufficiently large to be of very low brightness. In suitable cases this can be done, but since fluorescent lamps are so easily and cheaply louvred it is true to say that it is easier to produce comfortable lighting with them than with other types of lamp.

If an unlouvred trough type of fitting is used in a classroom it should be mounted with its major axis across the room since in this way the sides of the trough will conceal the lamps from both teacher and pupils when looked at from normal positions. If the fittings have transverse louvres it is perhaps better to place them lengthways along the classroom since the lines of fittings help to lead the eye towards the teacher.

The low brightness of a fluorescent lamp used for chalkboard lighting minimises the chance of specular reflections from the board and the length of the lamp ensures an even illumination along the length of the board. In fact the lighting of the chalkboard is so much better suited to fluorescent lamps than any other illuminant that in some cases where filament lamps have been used for general lighting, fluorescent fittings have been installed just for the chalkboards. While common practice is to have a lamp suspended above and in front of the board in a special reflector so that

the light is concentrated over the board with the maximum candle-power aimed towards the bottom, there is no reason why the lighting should not come from beneath where this is more convenient.

While classrooms form a large proportion of the total space in schools there are many other rooms where fluorescent lighting can be used to advantage. Art rooms, in particular, require a high standard of lighting and the colour emitted by fluorescent lamps has been of real assistance in enabling work to continue under artificial lighting, whereas in many cases work formerly had to cease when daylight faded. The diffused nature of the light is generally regarded as being very satisfactory for two-dimensional work provided there is no more overlapping of light from adjacent fittings than is necessary to give a uniform level of illumination. In some instances, however, where sculpturing or modelling is done fluorescent lighting has been found too "flat" and some additional directional filament lighting has been found necessary. In such cases it is desirable that the same blend of light should be installed throughout the room.

Among other rooms of a specialised nature where fluorescent lighting can be advantageously employed are the laboratories, where the colour is again of particular benefit. In workshops the lighting should be as nearly as possible representative of standard practice in modern light industry, which is now mainly fluorescent-lit.

The lighting of corridors by fluorescent lamps should not be overlooked. These frequently have little daylight and artificial light has, therefore, to be used for long hours. Where notice boards or display space is provided in corridors the lighting of both may be combined by fluorescent lamps over the boards screened from side and end view but allowing upward and downward light.

Fluorescent lighting is also suitable for the gymnasium, preferably using fittings each housing two lamps with a phase displacement to obviate possible stroboscopic effect when fast ball games are played. The fluorescent lamp has the advantage that the large source gives a minimum of glare when looking directly upwards as will inevitably occur in gymnasia.

There is, in fact, no room in the school where fluorescent lighting is not suitable, although its particular advantages are most apparent in the cases mentioned above.

Economics

Fluorescent lamps are from two to three times as efficient as tungsten filament lamps of corresponding wattage. The implication of this on the national fuel and power situation, as well as the effect on

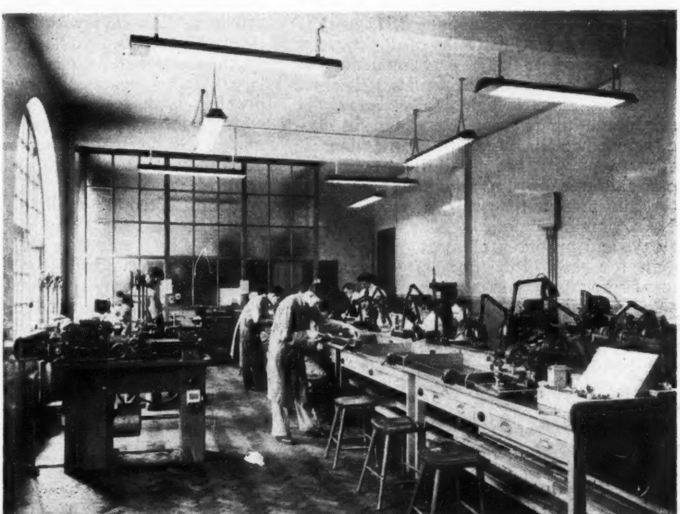


Fig. 2. General overhead fluorescent lighting used to supplement daylight in a technical school workshop. Additional local lighting is provided on the benches.

running costs, is obvious. Furthermore, when existing buildings are being relit to modern standards by fluorescent lighting the existing mains will in many cases be found adequate.

It is in the comparative economics of the different systems of lighting that there is great divergence of opinion to-day, and it is only by considering the economics as a whole that one can put into proper perspective the greater efficiency of fluorescent lamps.

Briefly, fluorescent lighting equipment costs more to buy in the first instance than corresponding equipment for filament lamps. This can only be economically offset by cheaper running costs. The running costs per annum of the installation depend on the number of hours of burning and the cost of electricity. The latter item can be found out beyond dispute, and we can even forecast the probable trend of the cost of energy in future years, but a reliable estimate of the number of hours for which the installation is, or will be, used is much more difficult to obtain. Observation and inquiry very soon make it clear that this is a matter on which a great deal more information and education is necessary.

Artificial lighting is needed in the classroom or elsewhere when the daylight level of illumination inside the building falls to an inadequate level. The level considered satisfactory on desks in classrooms is presumably either the minimum of 10 lm/ft.^{2} required by the 1944 Act of the Ministry of Education or the minimum of 12 lm/ft.^{2} recommended by the Code of Practice, or the average of 15 lm/ft.^{2} recommended in the I.E.S. Code. All authorities will agree that when the daylight falls below the appropriate figure in a classroom it *must* be supplemented by artificial lighting in order to prevent the total illumination on desks falling below the minimum acceptable.

At the present time this is very far from being common practice. The teacher of to-day, and probably of most other generations, too, has little time left in class to worry about the surroundings unless it is quite obvious that they are impeding the lesson. The result is that the daylight can become so dim that someone has to complain before the lights are switched on, and this usually happens at about 3 lm/ft.^{2} minimum.

It would thus appear that though the modern trend for lighter and healthier schools has made better facilities available, they are often not very logically used. The arguments for having an adequate standard of lighting have been put forward earlier in this series, but they still need to be brought home to the teacher in terms of realities. Practical arrangements to relieve the teacher from being ever on the alert for bad lighting conditions include automatic switching by photo-electric cell, or some simple vision chart placed in each classroom which would tell at a glance if there is sufficient light.

From available data it is possible to estimate the number of hours for which the artificial lighting will be required in schools. Knowledge of the daylight factor of each important room in the building under consideration is essential in estimating this figure, and in this connection schools can be divided into two categories for lighting: the very old buildings where the lighting needs to be brought up to date, and the most recent buildings where the lighting is being installed as the school is built. In the old-type building a 1 per cent. minimum daylight factor is, if anything, optimistic, especially in cities, and it is in these buildings that artificial lighting has a very important part to play. In new buildings the minimum daylight factor may rise to as high as 15 per cent., and in these the daylight will not usually require to be supplemented until dusk. The diagram shows that daylight factors much greater than about 2 per cent. are hardly worth striving for if the main object is to save artificial light, and one wonders how much additional constructional cost is involved in providing buildings with exceptionally high daylight factors, and, incidentally, how much additional heat is lost through these large window spaces. Conversely, a further problem is the screening of direct sunlight, which, with large window areas, not only makes the classroom extremely hot but is an annoying source of glare and high contrast.

Unobstructed daylight illumination figures over the whole year compiled by the N.P.L. are given in the table below.

These show, among other things, that outdoor illumination is below 1,000 lm./ft.^{2} during the greater part of the day for 140-150 days of the year. In the case of an old school building being relit to modern standards but having only a 1 per cent. daylight factor this means that at the start and finish of the day inner parts of a classroom receive less than 10 lm./ft.^{2} during almost half the number of school working days. This takes into account the fact that major school holidays occur during the spring and summer.

Thus even in primary schools, in order to

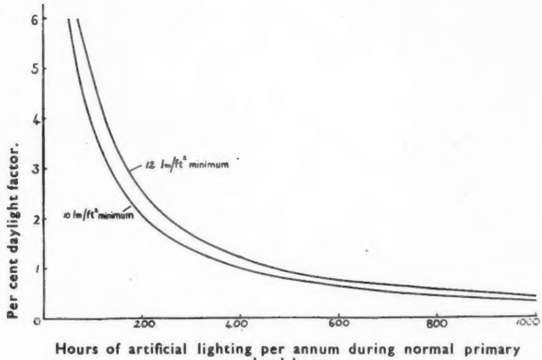


Fig. 3. Relationship between daylight factor and annual artificial lighting hours.

Unobstructed Daylight Illumination
During the Year*

Illumination values	Teddington			Edinburgh		
	Number of days in the year			Number of days in the year		
	9a.m.	Noon	3p.m.	9a.m.	Noon	3p.m.
lumens/ft.,^{2}						
Below 100	6	3	14	19	1	12
,, 200	21	9	35	47	4	37
,, 300	36	16	53	72	11	63
,, 400	54	25	77	88	17	81
,, 500	67	33	94	104	26	94
,, 600	83	43	110	118	33	109
,, 700	97	55	121	130	44	120
,, 800	111	68	135	139	53	132
,, 900	125	80	146	149	66	141
,, 1000	141	93	157	158	80	149
Above 1000	224	272	208	207	285	216

* Post-war Building Studies, No. 12, The Lighting of Buildings, App. 1.

maintain the bare minimum of 10 lm./ft.^{2}, the artificial lighting will be required for about 400 hours per year, or to provide the recommended I.E.S. Code level of an average of 15 lm./ft.^{2} (corresponding to about 12 lm./ft.^{2} minimum), it will be required for nearly 500 hours per year. These figures do not allow for any evening functions for which most schools are used at some time or other.

Consider now the relative economics of two alternative systems of lighting, one by eight 150-watt filament lamp fittings of the enclosed diffusing type, costing £2 each, the other by six 80-watt fluorescent fittings, costing £10 each. Assume that the capital cost is to be spread over ten years and that the cost of electricity is 5d. per unit (a figure which seems to be about the average price paid by schools).

A convenient method of working out the examples has already been published in *Light and Lighting*, August, 1950. The formula given is:—

Total annual cost of lighting =

$$A + LH + WHC + \frac{TW}{1{,}000}$$

As there is no kilowatt charge in this case, the expression $\frac{1{,}000}{TW}$ is omitted, and we can then substitute as follows:

A = Annual capital charge over ten years (pence) =

Filament	Fluorescent
$\frac{8 \times 2}{10} \times 240$	$\frac{6 \times 10}{10}$

L = Cost of lamps per 1,000 hours burning, including purchase tax (pence) =

Filament	Fluorescent
34×8	$\frac{228 \times 6}{3}$

W = Total wattage consumed =

Filament	Fluorescent
150×8	$(80 + 20) \times 6$

C = Cost of electricity per kw.h. =

Filament	Fluorescent
5d.	5d.

H = Thousands of hours of use of the installation =

Values of 0.3, 0.6, 0.9, 1.2 and 1.4 are considered.

We thus have the following table of comparison:—

Annual hours of artificial lighting	Total Annual Cost	
	Filament	Fluorescent
300	£9 9 0	£10 6 0
600	£17 6 0	£14 13 0
900	£25 2 0	£18 19 0
1200	£32 19 0	£23 5 0
1400	£38 3 0	£26 3 0

It will be seen that the two systems cost about the same per annum when used for 400 hours, but that the advantage is in favour of fluorescent lighting as the hours increase. While the cost of filament-lamp lighting increases four times to provide lighting for 1,400 hours compared with 300, the cost of fluorescent lighting increases only two and a half times. Thus, the installation of fluorescent lighting is an assurance that any increase in the use of artificial lighting, whether or not anticipated at the time of installation, can be provided at minimum extra cost.

Finally, in deciding whether fluorescent lighting is to be used for a particular installation every case must be taken on its merits. It is clear that, in general, fluorescent lamps will provide the most suitable and acceptable lighting for schools and that in very many instances they are also the most economical sources available.

Some Views on the Lighting of Station Names

All railway travellers, both occasional and habitual, complain of the difficulty of locating and reading station names whilst travelling. The author briefly reviews the subject, but—to quote his own words—what of the future ?

By A. CUNNINGTON, B.Sc., M.I.E.E., F.I.E.S.

Sir John Parsons' recent complaint of the illegibility of station names, which was referred to by "Lumeritas" in the January issue of *Light and Lighting*, and the subsequent comment of a judge on "the passionate anonymity displayed by railway stations," has once again brought up this problem which is ever with us.

In one sense, of course, legibility is more important than lighting, since a large amount of travelling takes place when artificial light is not needed to display the station name. Nevertheless, most travellers are less certain of their whereabouts on a railway during the hours of darkness, and there is a crying need for names to be not only legible but well lighted. The Board of Trade in the days when it controlled railways seems to have recognised the importance of illuminated names, for it was a regulation that each lamp should display the station name in a legible manner. The old-fashioned oil lamp, taking the form of a square lantern fixed on a post or bracket—the type of lamp beloved by cartoonists and film directors, from the "Ghost Train" onwards—had on its front pane a translucent glass plate carrying the station name in letters that were illuminated from behind. (This, incidentally, must have been one of the earliest examples of illuminated signs.) Except that the illumination given was exceedingly small, the device might have been fairly satisfactory had there been a great number of these lanterns all along a platform, but as they were usually at least 50 feet apart there was not much chance of reading the name for a passenger in a compartment that came to rest midway between two lamps.

Later, when more modern gas lamps with spherical globes were introduced, it was realised that the station name could not be satisfactorily written on the globe, and small glass panels with the name in translucent

lettering were hung separate from, but immediately in front of, the lamps. At some stations the opportunity was taken to hang two name-plates on each lamp, facing obliquely in either direction along the platform. This showed some appreciation of the importance of siting the station names to the best advantage, and it brings to mind that before the end of the last century the then Midland Railway made a practice of fixing large name-boards in the form of a very obtuse-angle V, so that the name faced in both directions and could be read after a train had passed the sign. It seems a pity that such a simple and effective device has not been perpetuated, and it is still more to be regretted that these "V" signs were never illuminated.

It is perhaps too much to expect that a passenger in any part of a train should be able to see the station name when the train pulls up, but even if a limited visibility is conceded for those passengers only who may be next to a window, there would still be need for an enormous number of name-plates, and each of these would have to be illuminated individually unless the general illumination of the station were of an exceptionally high order.

Passengers seem instinctively to look towards a lamp when trying to ascertain the name of a station after dark, and this is probably why at many stations—at least in the South of England—name-plates with clear lettering have been fixed in proximity to all lamps; but even when dozens of such name-plates are provided it seems painfully easy to find a "blind spot."

The London Tube railways have got near to a satisfactory solution of the problem by posting the station name at very frequent intervals along *both* walls of the station tunnel. It is almost impossible to miss the name under these conditions, but unfortunately the system is hardly applicable to surface stations where, owing to differences in construction and arrangement of station buildings, there would often be an obstruction between the passenger and the name.

In spite of the difficulties in lighting the name-plates adequately, some of which have been mentioned, it seems that some satisfactory compromise should be devised. For example, if every platform had a V-shaped illuminated name sign in bold characters fixed preferably in three positions—at the entering point, at the middle, and at the end —passengers would have a reasonable chance of catching sight of the name, and if it had been missed in passing, it could easily be seen when the train came to rest by lowering the window and looking out.

It is interesting to recall that some experiments on these lines were carried out on the former South-Western Railway about 30 years ago. At that time V-shaped box signs were fixed at intervals along the platform, and the lettering was, of course, illuminated from behind. These were successful in that one could always see the name either from the compartment or by putting one's head out of the window, but the signs were hardly big enough to catch the eye in passing and the device never became generally adopted —possibly owing to its considerable cost.

What of the future? Will British Railways standardise some improved system of illuminated station names, or will the bugbear of cost again hinder development? Alternatively, shall we see a widespread adoption of the public address system which has already been installed at a number of interchange stations? Audible indication of whereabouts is undoubtedly more "foolproof" than the most elaborate system of illuminated names. But why not have both? Surely the legibility of station names both by day and by night is an aim which should have a high priority among the amenities—better and brighter trains, stations, refreshment rooms, etc.—to which we look forward from our nationalised railways.

Fluorescent Lighting in Offices

(*Continued from page* 169)

lighting conditions were obtained. Fig. 4 shows a general office at Lever Bros (Port Sunlight) Ltd., where the lighting is aimed at enhancing the spacious appearance of the interior. Each lighting unit is mounted in the frieze recess between pillars and houses three banks of four 80-watt fluorescent lamps behind hinged covers of fluted "Perspex." The average service illumination over the area is some 20 lm./ft.^{2} and the low brightness of the units seen against a well-lit background ensures glare-free conditions.

Fig. 5 shows the general reception office and concourse of the Canadian Pacific Railway Co., Ltd., in the Royal Liver Building, Liverpool. In this case individual units, housing up to nine 80-watt fluorescent lamps, are installed to give an average service illumination of just over 20 lm./ft.^{2} The side frames of the fittings are made of aluminium extrusions to match the capitals of the pillars. These opaque sides, together with the large box louvres, screen the lamps from normal view and ensure pleasantly glare-free lighting.

New Lighting Installations

A new service department designed by W. M. de Majo was recently opened at Ronson House in the Strand, London. In the new department customers bringing in lighters for repair or overhaul can see the work actually being carried on in the workroom in which colour and lighting by means of daylight fluorescent lamps have been applied to produce a bright and efficient atmosphere.

Light and colour have also been skilfully applied on the customers' side of the counter. A disguised structural column has been provided with indirect lighting around the top and indirect lighting by fluorescent lamps is also installed along the top edge of the partition wall over the counter. Additional and accent lighting is provided by recessed circular glass panels and spotlight reflectors.

The use of fluorescent equipment for restaurant lighting presents particular problems of aesthetics and colour. The use of

Interesting lighting features installed in reception room of the new Ronson Service Department.

standard fittings invariably produces brightness incompatible with the impression many restaurants aim at achieving, and the length of the fitting in relation to the width is too familiar to allow an individual atmosphere to be attained.

An installation which attempts to overcome this aesthetic problem has been recently completed at the S.F. Grills and Restaurant, London, W.1, in which large, low brightness luminous areas create a very restful, pleasant atmosphere, with acceptable architectural proportions. The main lighting system is based on aluminium frames glazed with peach Veneeropal, cross beams being used as cut-off baffles and the width of the frame adjusted to give cut-off of the frame suspension and the lighting equipment. "Atlas" batten type units with "Quickstart" control gear are used. The complete lighting system was designed and supplied by Thorn Electrical Industries Limited and installed by T. H. Tacchi.

Lighting in a London restaurant, using fluorescent lamps concealed behind baffles.

Showing the new installation of fluorescent lighting in a London bank.

Fluorescent Lighting in a London Bank

The relighting of the London bank, illustrated above, was recently carried out by Messrs. Girdlestones, Ltd., using equipment supplied by Messrs. Courtney, Pope (Electrical) Ltd. The conditions governing the relighting were that the existing points should be used, that the decoration should in no way be damaged, that use of local lighting should be avoided, and that fluorescent lamps should be used. It was also required that the fittings used should harmonise with the architectural features of the building, and that the average level of illumination should be 12 lm/ft^2.

Twelve of the sixteen fittings used are large and house fourteen 4-ft. 40-watt fluorescent lamps in each. Eight of these lamps are placed in pairs around the perimeter of the fitting behind the curved reeded " Perspex " diffusing panels. The other six lamps are fitted above the centre square, which is subdivided into glass panels with a small bronze moulding used as a drop section in the centre.

The glass used in the manufacture of the fitting is half-inch cross reeded with a white acid finish. For the centre drop section plain white acid glass is used. The curved diffusing panels are in reeded 030 " Perspex " and are covered by clear sheet for upward light, while the centre square is covered by two white enamel hinged reflectors. These fittings are each supported by a 1¼-inch heavy gauge steel tube, supplemented by four ¾ inch tubular drop rods to give a more balanced appearance.

Although the remaining four fittings are narrower and smaller than those described, they are similar in general appearance. These house eight 4-ft. 40-watt lamps and 2-ft. 40-watt lamps. The control gear in these smaller fittings is housed in the fitting itself and is secured to the hinged reflector. For the larger fittings the ballast units for the lamps are housed in the ceiling box, and the starter switches are in the fitting adjacent to the lamps. The colour of the lamps used are " warm white " for those fitted around the perimeter of the fitting and " daylight " above the centre panels.

The resulting effect of this new installation is satisfactory; the light output is efficient and the fittings harmonise with the general decorative scheme.

Cold Cathode Lighting at Victoria Station

Another installation of cold cathode fluorescent tubes for station lighting on the Southern Region of British Railways was brought into use when the reconstructed Eastern Section Booking Hall was opened at Victoria recently. The first application of this type of illuminant at stations in Great Britain was made by the former Southern Railway when the Motspur Park to Chessington branch was opened in 1938. Post-war installations on the Southern have included the lighting of the boat train platform at Victoria, undertaken when the Golden Arrow London-Paris service was restored in 1946, and lighting in the new booking hall at Hastings, where the scheme adds to the effectiveness of a frieze of mural paintings. The equipment for all these installations has been supplied by The General Electric Co., Ltd., whose engineers have collaborated with the Chief Civil Engineer's Department of the railway in planning the lighting schemes.

The new booking hall installation at Victoria demonstrates the application of cold cathode tubes for providing decorative effects as well as efficient lighting. Over the centre of the hall a rectangular lighting feature 30 ft 10 in. long by 11 ft. 10 in. wide has been built up with standard G.E.C. three-tube units placed end to end. This is supplemented by six 5 ft. diameter double circles of tubing at each side of the hall.

Two colours of cold cathode tubing, Intermediate White and Gold, are used in these general lighting fixtures, the three-tube fittings each containing two whites and one gold while the circles are formed of one tube of each colour. With this combination it has been possible to provide a high average level of illumination (20 lumens per sq. ft.) with a warm and attractive quality that in itself can be considered one of the amenities of the new booking hall. The high and uniform level of general lighting has made it unnecessary to provide local illumination for time-tables and notices.

A single line of Intermediate White tubing, 47 ft. long, is recessed behind glass panels over the booking office to give additional local lighting at the ticket windows. The transformers required for operating this tubing and for the six circles are in groups behind the walls at each side of the hall.

Cold cathode lighting in the booking hall at Victoria Station.

Correspondence

Lenticular Pigmentation

To the Editor of LIGHT AND LIGHTING.

Sir,—May I comment on a report of "Recent Meetings of the Colour Group," which appeared in LIGHT AND LIGHTING, April, 1951, p. 146. Mr. Warburton's paper is reported and the statement is made: "Thus observers weighting different parts of the spectrum differently obtained results which gave an indication of the extent of their "macular pigmentation." I would suggest that "macular pigmentation" be replaced by "lenticular pigmentation," because there is a complete absence of clinical evidence for macular pigmentation in intact normal eyes, whereas, on the other hand, there is clinical evidence for increasing pigmentation in the crystalline lens as age advances.

I feel that it is very important that lighting engineers should be correctly informed on established clinical findings.—Yours, etc.,

H. HARTRIDGE, M.D., SC.D., F.R.S.,
Director, Vision Research Unit.
London.

Brightness Engineering

To the Editor of LIGHT AND LIGHTING.

Sir,—In your April issue Mr. Robinson takes me to task for the remarks I made in March about the one-to-one ratio of the American "Q.Q." Committee for idealised visual conditions. I said that Mr. Robinson had quoted this recommendation but I do not think my words implied that he endorsed it; if they did I ask his pardon. However he appears to endorse it in his letter and I must join issue with him on another point he makes. He says that brightness ratios relate to visual comfort alone but in his paper (section 3.2) he says the "Q.Q." Committee prepared their code of brightness ratios from observational studies and the results of relevant researches, particularly those of Lythgoe. But Lythgoe's work was concerned with *visual capacity* and *not* with *visual comfort*, and, anyway, it does not support the one-to-one ratio.

Accepting, however, Mr. Robinson's statement that brightness ratios as recommended by the "Q.Q." Committee do relate to visual comfort alone, I cannot possibly agree with him that, "In this limited sense it is, in fact, true that a uniformly bright field must represent the acme of visual comfort. . ." Why *must* it; and where is the evidence for this conclusion? Apart from Mr. J. G. Holmes's refutation of this contention on the basis of actual experience (*vide* discussion on Mr. Robinson's paper, Trans. I.E.S., **16**, 78, 79, 1951), a "uniformly bright field is a visual vacuum" (unless the field is colour patterned), and is it not nonsense to assert that this vacuum affords the maximum comfort to "the most perfect organ of sensory *discrimination* of all that have been evolved" (Parsons): to assert, in effect, that the acme of visual comfort is only to be secured by the abnegation of what we really mean by "vision"?

If I made the contrary assertion that a uniformly bright field must represent the acme of visual *discomfort*, no doubt this would be said to spring from "emotional considerations." Yet I venture to suggest that such an assertion could be better defended than that which Mr. Robinson makes. I think, with Mr. Ackerley (*vide* discussion referred to), that there is some talking at cross-purposes about the American recommended brightness ratios; if so, it is invited by the verbal formulation of these recommendations.—Yours, etc.,

"LUMERITAS."
London.

To the Editor of LIGHT AND LIGHTING.

Sir,—At first sight the Brightness Ratio method of specifying lighting quality has an attractive simplicity, but it seems rather doubtful whether the British I.E.S. Code would benefit from its adoption as proposed by the author of a recent I.E.S. paper; especially since new researches described by Luckiesh and Guth (Ill. Eng. Nov., 1949) suggest that the theoretical basis of the system is shaky—not because Holladay's classic measurements were at fault, but because unwarranted conclusions were drawn from them.

This work by Luckiesh and Guth, together with researches such as those of Petherbridge and Hopkinson, Ward Harrison and Logan, make it increasingly obvious that any satisfactory quantitative approach to brightness engineering must take into account, directly or indirectly, a number of additional factors besides brightness; such as

the area and disposition of the glare sources in the field of view and the general brightness level to which the observer's eyes are adapted.

Much useful research has been directed toward the evolution of formulae whereby the combined effect of these factors can be approximately measured or predicted; but all too often investigators seem to regard the bare formula as a satisfactory end-product.

This attitude is a trifle unrealistic. No matter how precise the formula may be it is of little use to the practical field engineer in its raw state, for the latter cannot be expected to make complex calculations about the brightness distribution and the total steradians subtended by his sources—even if he has at his disposal a set of Inter-reflectance tables and the ingenious perspective protractor devised by Logan. Devices of this kind are of the utmost value to the research man, as are elaborate instruments for measuring glare in existing installations—provided that they work. But what the ordinary field engineer really needs is a method which will enable him to *predict* the degree of glare while his lighting scheme is still on the drawing-board (or at least to predict whether it falls inside or outside some predetermined limit). Moreover this method should be at least as simple to use as the familiar Coefficient of Utilisation tables now used to predict illumination level.

In my opinion most laboratory investigations on glare have given far too little attention to the problem of presenting data in a readily usable form. This is all the more surprising since a method which is really convenient (and yet capable of reasonable precision) has already been proposed. I refer to the tabular method developed by Ward Harrison and Phelps Meaker to display the results of calculations based on their tentative Glare Factor formula. Even if we ignore completely the merits of the latter formula, the tabular method of presenting such data in a pre-digested form is still an invention of first-class importance in its own right, for it supplies the essential bridge between the laboratory worker and the field engineer. There is no obvious reason why tables of this kind could not be used to interpret any set of glare formulae which purport to be comprehensive enough for practical use, and researches in this field should not be regarded as complete until something of the sort has been attempted.

This does not mean that we can afford to sit back and wait for the laboratories to evolve suitable formulae. Fundamental researches of the type pursued by Petherbridge and Hopkinson or Luckiesh and Guth are of the utmost importance, but the field to be explored is so vast that it may well be years before we can expect a set of precise and universally applicable formulae from laboratory measurements alone. It seems to me that if we are to make effective progress we must attack the problem on a broad front. I therefore suggest that all members of the Illuminating Engineering profession (particularly those who are concerned with the drafting of codes and standards) should give very serious thought to the development of practical tables based on existing laboratory data leavened with plenty of check testing against actual field installations. In other words we should make much more use of the semi-empirical approach first proposed by Ward Harrison some six years ago.

Even if it is not considered possible to go the whole way at once and express glare in precise numerical terms which can be handled as readily as lumens per sq. ft. are now, we can at least take a few steps along the road by producing tables connecting fitting brightness, room size, mounting height, and illumination level; tables which are in fact an extension of the permissible fitting brightness table on page 10 of the present British I.E.S. Code.

Such an approach is quite feasible and is actually under consideration in Australia at this very moment. The Standards Association of Australia is now revising and bringing up to date its war-time emergency artificial lighting code published in 1942, and the drafting sub-committee are investigating the possibility of including simple tables of the last-mentioned type.

As this work is incomplete (the tables are now being subjected to practical field tests) it would not be appropriate to say any more about the matter now; but full details of this work will be published in due course, and as the writer is scheduled to deliver a paper to the Australian I.E.S. dealing with this and other aspects of the Quality section of the new code, some details at least of the work and of the assumptions upon which it is based will be available later in the year.—Yours, etc.,

J. C. Lowson.

Dept. of Labour and National Service, Melbourne, Australia.

I.E.S. ACTIVITIES

London

At the London Sessional meeting on April 10 a paper entitled "Recent Developments in Gas Street Lighting" was given by Mr. P. Crawford Sugg. The paper detailed the improvements and changes which have been made in low-pressure gas street lighting equipment since the end of the war.

The economics of gas street lighting, particularly those of Group "B" lighting schemes, have been greatly improved by changes in the design and construction of the lanterns which permit major revisions in the system of maintenance.

The first part of the paper described the changes made in a reflector lantern to obtain these results. These may be summarised as an increase of 40 per cent. in the efficiency of light production as compared with the old square lanterns, improvements in the technique of manufacture of the reflector system, and the devotion of considerable attention to the aesthetic aspects of the design, resulting in the passing of a bracket-mounted form of this unit by the Royal Fine Art Commission.

Service duty tests were carried out on installations of this type of lantern, operating without any maintenance, over many weeks of severe weather. The chief factor effecting the duty of gas lanterns is the accumulation of dirt on the glassware. It was known from experience with older lanterns that a duty in service of 75 per cent. of the initial effect could be maintained, if necessary, under penalty, with fortnightly attention. The tests on the new lanterns, however, demonstrated that a duty of 70 per cent. of the initial light output could be maintained under similar conditions, when cleaning the new lanterns at five-weekly intervals. This was under severe winter weather conditions in London. In normal weather the duty was still higher. It will be seen that this performance which permits a considerable reduction in labour is entirely consistent with the 60 per cent. (and preferably 70 per cent.) maintenance requirements stated to be desirable in the Code of Practice on Street Lighting recently distributed for comment. New automatic control equipment, based on the use of a 42-day movement and the solar dial, has been introduced to take still more advantage of the reduced attention necessary for the new lanterns.

A description was also given of a new range of refractor panel lanterns for both Group "A" and Group "B" lighting, which is of good external appearance and extreme simplicity of constructional functions of the control of the light distribution being carried out by the use of diffusing or refracting glassware. The prismatic surfaces of the glass are covered to assist routine cleaning. Installations of these refractor lanterns were also subjected to the service duty tests mentioned above, and were found to show even less depreciation and similar advantages of notable economy of maintenance.

Modern practice in regard to the mounting of accessories such as controllers and governors on these lanterns was described, together with the methods employed to ensure economy of gas consumption in service and simple adjustment.

The normal scheme of maintenance for the new lanterns, envisaged cleaning and clock-winding at intervals of four weeks, with a small percentage of burner cleaning, and a time allowance for any unusual attention, such as may be caused by malicious damage or mechanical failure, together with a proper nightly patrol system. Such a maintenance system compares very favourably with those still in common use with the older lanterns, which involve weekly, or fortnightly, attention.

This advantage in maintenance cost, in conjunction with the greatly improved performance of the new lanterns and the possibility in certain cases of making use of existing column equipment and services has, it is understood, resulted in the increasingly wide use of these types of lanterns.

Birmingham Centre

The last sessional meeting of the Birmingham Centre was held on March 9, 1951, when Mr. H. C. Weston gave a paper on "Light and Vision." There was a good attendance and among the visitors were a

number of nurses from the local eye hospital.

The speaker emphasised that only a selective treatment of the subject was possible in the time at his disposal. He spoke briefly of the work of Lythgoe in connection with the present vogue of brightness engineering and showed by means of graphs and diagrams how visual acuity is affected by the brightness or luminance of the surround. Mr. Weston deprecated the enthusiasm in some quarters for a one-to-one ratio, and after reviewing the conditions, i.e., the amount of light, the object to be seen, etc., showed that satisfactorily high acuity is obtained with a ratio of three or more to one. Increase of illumination reduces visual perception time, and good illumination is particularly desirable for unfamiliar visual tasks. Mr. Weston concluded by saying that the study of vision is a very fascinating one, that there was quite a lot yet to be learned and a great deal of research remaining to be done.

In the discussion which followed Dr Holland said that pilots operating at very high altitudes had seen annoying patterns appearing on the toughened glass windows, and he wondered how sensitive the eye is to polarised light and if intra-ocular pressure caused by the altitude was a possible explanation. Another speaker asked whether the fact that the surround introduced some discomfort glare was of any consequence. Mr. Weston said he had known cases of workmen being helped by the introduction of a glare source.

The lecturer was asked whether there was a standard illumination laid down for opticians' clinical charts, and he replied that although there was not one at present, he hoped that as a result of recent work a standard of 50 lumens/sq. ft. would be adopted in the near future.

Another questioner asked whether the colour difference of the various light sources in present use affected visual acuity. Mr. Weston said a Government department had recently made tests between tungsten and fluorescent lighting and had found no difference for equal values of illumination.

A vote of thanks proposed by Mr. Cassidy was passed with enthusiasm.

Sussex Group

The Sussex Group held an open meeting in the Demonstration Theatre of the Eastbourne Electricity Showrooms, on Tuesday, February 27, when a talk was given by Dr. Ballin on "The dimming of fluorescent lamps."

The attendance was 78, and amongst those present were the Borough Engineer of Eastbourne, Mr. Williams; the Borough Architect of Hastings, Mr. Ripley; contractors from Hastings, Bexhill, and Eastbourne, members of borough surveyor's staffs from Hastings, Bexhill and Eastbourne, representatives of the board from these three places and the Weald and Tunbridge Wells districts, and the I.E.S. members themselves who came from Bognor, Worthing and Brighton.

The paper, which was extremely interesting, dealt primarily with the dimming of fluorescent lamps as applied to stage work, and Dr. Ballin had draperies, battens, floodlights, etc., all equipped and operated, to show what very lovely effects could be obtained by colour mixing and dimming.

A lively discussion followed Dr. Ballin's lecture in which some dozen speakers took part. The sub-area and district managers were thanked by Major Green on behalf of the I.E.S. for their hospitality and for making arrangements for a highly successful meeting.

Bath and Bristol Centre

The Bath and Bristol Centre held their annual luncheon on Friday, April 6, when approximately 100 members and guests were present. The chairman of the Centre, Mr. H. J. Weston, presided. The Centre are to be congratulated on the high standard which they have maintained in connection with this annual event.

The toast of "The City and County of Bristol" was proposed by Mr. R. E. Tucker, a past-chairman of the Centre, who, as a resident of Bath, applauded the co-operation between the two cities which had been largely responsible for the success of the Centre. The reply was made by Alderman P. W. Cann, Deputy Lord Mayor of Bristol, who spoke of improvements in the standard of living which had been brought about as a result of the efforts of the I.E.S. to get people to appreciate the need for good lighting.

The toast of the I.E.S. was proposed by Mr. Hugh Roberts, F.R.I.B.A., and Mr. L. J. Davies, president of the Society, replied. Mr. W. Bowler, also a past-chairman of the Centre, proposed the toast of the guests and the reply was made in a very entertaining manner by the Rev. Mervyn Stockwood.

Later in the afternoon Mr. L. J. Davies and Mr. G. F. Cole attended the annual general meeting of the Centre.

NATIONAL ILLUMINATION COMMITTEE OF GREAT BRITAIN

(Affiliated to the International Commission on Illumination)

ANNUAL REPORT FOR THE YEAR 1950*

Following the changes made in the Rules of the Committee in the latter part of 1949, invitations were sent to all bodies previously represented on the Committee to become Sponsoring or Co-operating Organisations, as appropriate. It is gratifying to be able to report that of the 27 such bodies approached, 26 accepted the invitation, whilst the other, for the purpose of representation, was merged with its parent organisation. In addition seven other bodies, not previously represented on the Committee, were given similar invitations, and of these the following four accepted, the names of their representatives being given in brackets: British Electricity Authority and its Area Boards (Messrs. R. Birt and M. D. Stonehouse), British Plastics Federation (Dr. W. E. Harper), National Coal Board (Messrs. R. Crawford and D. A. Strachan) and the Ministry of Fuel and Power (Mr. P. E. Montagnon). It can thus be said that the Committee is truly representative of all lighting interests in this country, and that its financial affairs have been put on a firm basis.

Certain minor modifications have been made to the Rules by the Committee of Administration and correction slips have been issued to members.

A number of changes in membership have occurred during the year; the details are as follows: Dr. R. G. Hopkinson has replaced Mr. W. Allen as the representative of the Building Research Station, Messrs. J. B. Carne and F. W. Sansom have been appointed by the Gas Council in place of Mr. A. M. Bell and the late Mr. D. Chandler, whilst Mr. H. G. Litchfield has replaced Mr. R. Broadbent of the Ministry of Civil Aviation, and Mr. D. A. Hughes has replaced Mr. A. Scott of the Ministry of Health. Mr. L. J. Davies has been nominated as an additional representative of the Electric Lamp Manufacturers' Association, and Mr. M. A. McTaggart has been similarly nominated by the Ministry of Labour and National Service, whilst the Railway and London Transport Executives are now represented by Messrs. A. J. Bull and H. E. Styles in place of Messrs. A. Cunnington and E. Morgan.

The next meeting of the International Commission on Illumination is due to commence at Stockholm on June 26 and to conclude on July 5, 1951. It is learnt that Finland has now become a member of the Commission, and that it is likely that a delegation from Germany will participate with full national status. Arrangements were in hand at the end of the year to compile a list of delegates from this country, with a Leader and Reporter for each subject. Dr. English has been nominated as Leader of the British delegation, with Mr. F. C. Smith as Deputy Leader.

The Central Bureau of the Commission has continued to issue Halath Letters and four more have been received. These have dealt in part with matters connected with the preparations for the Stockholm meeting, but several items of particular interest have been mentioned, and the C.I.E. Panel, previously appointed by the Committee, has met to deal with them in detail; the Panel's report is awaited.

In July copies of the 1948 Proceedings of the Commission were issued by the printers and these have been distributed.

The various Sub-committees have continued their activities, with particular reference to the forthcoming Stockholm meeting. In the three subjects in which this country acts as Secretariat, viz., Light Sources, Calculations on Projector Systems, and Theatre Stage Lighting, the collection of data from this and other countries has been carried out, although the response from other countries has not always been as prompt as could be desired. Secretariat Reports on these subjects have been sent, or were about to be sent, to the Central Bureau at the end of the year.

In connection with the work on the various subjects valuable assistance has again been given by the British Standards Institution, which has made available the work of seven of its Technical Committees. In practically every subject the appropriate

* Approved at the Annual Meeting of the Committee held on Wednesday, January 31, 1951.

Constitution of the National Illumination Committee on December 31st, 1950

Officers :—

Chairman : DR. J. W. T. WALSH.

Vice-Chairmen : DR. S. ENGLISH and F. C. SMITH

Hon. Treasurer : DR. S. ENGLISH, Holophane House, Elverton Street, S.W.1.

Hon. Secretary : L. H. MCDERMOTT, Building Research Station, 57, Onslow Gardens, London, S.W.7.

Representatives of Great Britain on the Executive Committee of the International Commission on Illumination :
DR. S. ENGLISH and F. C. SMITH.

Nominated by the Sponsoring Organisations:—

Illuminating Engineering Society: DR. J. N. ALDINGTON, G. G. BAINES, J. G. HOLMES, L. H. MCDERMOTT, J. M. WALDRAM.

Institution of Electrical Engineers: R. O. ACKERLEY, PROF. H. COTTON, C. W. M. PHILLIPS, H. R. RUFF, H. C. SPENCE.

Institution of Gas Engineers: J. B. CARNE, A. G. HIGGINS, W. HODKINSON, P. RICHBELL, F. C. SMITH.

Nominated by the Co-operating Organisations:—

Admiralty : H. A. L. DAWSON.

Air Ministry : J. E. CARPENTER.

Association of Public Lighting Engineers : N. BOYDELL.

British Electrical and Allied Manufacturers' Association : J. M. H. STUBBS.

British Electrical Development Association : V. W. DALE.

British Electricity Authority and its Area Boards : R. BIRT, M. D. STONEHOUSE.

British Plastics Federation : DR. W. E. HARPER.

Department of Scientific and Industrial Research : (*National Physical Laboratory*) DR. L. A. SAYCE, DR. J. W. T. WALSH; (*Building Research Station*) DR. R. G. HOPKINSON.

Electrical Contractors' Association : C. J. VENESS.

Electric Lamp Manufacturers' Association : L. J. DAVIES, W. J. JONES, E. B. SAWYER.

Electric Light Fittings Association : G. CAMPBELL, W. E. J. DRAKE.

Gas Council : J. B. CARNE, F. W. SANSOM.

Glass Manufacturers' Federation : DR. W. M. HAMPTON.

Institution of Municipal Engineers : C. HARPER.

Medical Research Council : PROF. H. HARTRIDGE, H. C. WESTON.

Ministry of Civil Aviation : H. G. LITCHFIELD, J. V. VERRAN.

Ministry of Fuel and Power : P. E. MONTAGNON.

Ministry of Health : D. A. HUGHES.

Ministry of Labour and National Service : M. A. MCTAGGART, E. W. MURRAY.

Ministry of Supply: E. S. CALVERT, Brig. E. J. H. MOPPETT, J. L. RUSSELL.

Ministry of Transport : DR. H. F. GILLBE.

Ministry of Works : W. E. RAWSON-BOTTOM.

National Coal Board : R. CRAWFORD, D. A. STRACHAN.

Post Office : W. T. GEMMELL.

Railway and London Transport Executives : A. J. BULL, H. E. STYLES.

Society of British Gas Industries : S. F. BAKER, P. C. SUGG.

Society of Glass Technology : DR. S. ENGLISH.

Sub-committee has answered a questionnaire from the Secretariat country, this work often involving the collection of a considerable amount of data.

The Mine Lighting Sub-committee has been reconstituted under the Chairmanship of Mr. R. Crawford, whilst two other changes of Chairman have taken place, Mr. J. L. Russell taking this position on the Aircraft Lighting Sub-committee in place of Mr. R. H. S. Mealing, and Mr. J. S. Preston acting instead of Mr. J. Guild on the Ultra-violet Light Sub-committee. Following the tests on automobile headlamps held in Holland in October, 1949, a short international meeting took place in Turin in October this year; this country was again represented.

Some discussion has taken place, both in the Committee and also with the Secretariat country, Australia, on the terms of reference for Architectural Lighting; the Secretariat has agreed with the opinion expressed by the Committee that this subject should not be studied separately, but instead be combined with Lighting Practice.

Lists of names and addresses of the members of the various Sub-committees have been sent to the Central Bureau for subsequent distribution to member countries. Similar lists from some of the other countries have been received from the Central Bureau.

In connection with Papers for the Stockholm meeting 14 titles (with summaries) were put forward by Sub-committees, and after these had been scrutinised by a small Panel 10 were submitted to the C.I.E. Papers Committee; of these eight have been accepted for presentation in full and the remaining two for reading in summary form.

It will be of interest to note that early in the year the following revised British Standard was issued: B.S.942:1949—Formulae for calculating intensities of lighthouse beams.

J. W. T. WALSH,
(Chairman).

Trade Literature

BENJAMIN ELECTRIC, LTD. Folder on the "Benjamin" photometer.

COURTNEY, POPE (ELECTRICAL), LTD. Catalogue on lighting equipment illustrating fluorescent lighting fittings and spotlights designed to solve a specific lighting problem.

CROMPTON PARKINSON, LTD. Leaflet on the Crompton "Louvalite."

J. A. CRABTREE & CO., LTD. Price list 190 of electrical wiring accessories, switch and fuse-gear and automatic control gear.

EDISON SWAN ELECTRIC CO., LTD. Folder on "Ensur-a-lite" emergency lighting equipment for use in hospitals, cinemas, theatres and municipal buildings.

EKCO-ENSIGN ELECTRIC, LTD. Leaflet on coloured fluorescent lamps, including technical data and price list.

ELECTRICAL REMOTE CONTROL CO., LTD. Folder containing leaflets on "Elremco" automatic control apparatus including photo-electric control gear.

B. FRENCH, LTD. Well illustrated booklet on electrical installations and heavy cable work.

GENERAL ELECTRIC CO., LTD. Comprehensive brochure on "Festive Lighting," including price lists and illustrated examples of floodlighting and interior and exterior decorative lighting.

LINOLITE, LTD. Leaflet A.12 and price list of internal reflection signs. Also leaflet No. 6 on fluorescent lamp reflectors and fittings suitable for shop windows, showcases and general lighting.

POSTSCRIPT

By "Lumeritas"

School lighting has again come in for criticism, this time by an optician who has just completed an investigation into the problem of myopia among schoolchildren. He says that poor lighting, aggravated by power cuts, causes the children difficulty in seeing—particularly in seeing what is written on the blackboard as "overworked teachers appear to have no time to clean chalk dust off the blackboard and to write slowly large and legible words and numbers. Thousands of normal-sighted children," he says, "must have been straining their sight to read the blackboards, and are rushed to clinics unnecessarily because they could not read illegible characters in semi-darkness." Of 16,076 children sent to clinics it was found that spectacles were unnecessary for 7,455, i.e., for 46 per cent. About 26 per cent. of those who did need spectacles were short-sighted. "But short-sighted children are often the clever ones. And for some reason teacher always puts the bright boys in the back row where it is most difficult to read the blackboard."

While on the subject of children's eyesight mention may be made of a paragraph in the recently published (February, 1951) Report of the Chief Inspector of Factories for the year 1949. Young persons between 14 and 18 years of age have to be medically examined for fitness for employment in factories, and, in 1949, nearly 3,000 were rejected. The Chief Inspector says, "Diseases of the eyes and eyelids, including refractive errors insufficiently or not corrected is *again* medically the most important cause of rejection. Excluding rejections for pediculosis, which primarily concern the girls, out of 916 boys rejected eye conditions were the cause in 313, while comparable figures for girls were 859 and 321. The total number rejected on account of disease of the eyes was, it is true, only about 0.21 per cent. of the large number of boys and girls examined, but, in addition to these rejections, about ten times as many young persons (2,885 boys and 2,848 girls) were, for similar reasons, only given certificates of fitness subject to the nature of their employment, while a further 1,517 boys and girls were given certificates subject to re-examination, and another 593 were given provisional certificates pending the result of advice concerning their eyes. All these figures are much larger than those relating to young persons rejected or given conditional certificates on account of any one of the other categories of defect, except pediculosis among the girls. One cannot help wondering to what extent unhygienic homes and school lighting may contribute to this state of affairs.

As the number of "televiewers" or "telelookers" grows, so, apparently, does the demand for bigger and brighter pictures. Any attempt to satisfy this demand will have to be made with the problem of flicker well in mind. It is known that the critical fusion frequency is a function not only of the luminance but also of the apparent size of the luminous field. The "high-light" luminance now obtainable with receivers using a 12-in.-diameter cathode ray tube is such that, at the usual viewing distance, flicker is noticeable with a blank "raster," i.e., when the screen is excited by the unmodulated scanning spot. When the field is "broken up" by the picture pattern relatively small areas have high luminance, and so there may be no noticeable flicker. But, if the high-light luminance now possible with 12-in. tubes is demanded of much larger tubes or screens, apart from the technical problems involved in getting it, there may be objections on account of flicker so long as the present system of transmission is retained.

Listening recently to a broadcast interview with members of the M.C.C. team just returned from Australia, I noted the remark of the wicket-keeper that "in Australia the light is clearer and you see the ball a little sooner." How well recognised it is, in sports, that quick seeing is a great advantage and that it depends on good lighting; and yet how often is this inadequately appreciated when the issue is not the winning of a game but the achievement of industrial efficiency or the prevention of accidents? Undoubtedly, many street and factory accidents would not occur if the victims of them could see the inflicting objects "a little sooner." Similarly, many jobs would be done a little quicker if the things they involve were seen "a little sooner." Birds are reputed to be much quicker of sight than humans: they need to be, for they move much faster—but then they have good lighting for their seeing! And the increasing hustle of life in our time is one of the reasons why modern standards of lighting ought to be high.

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